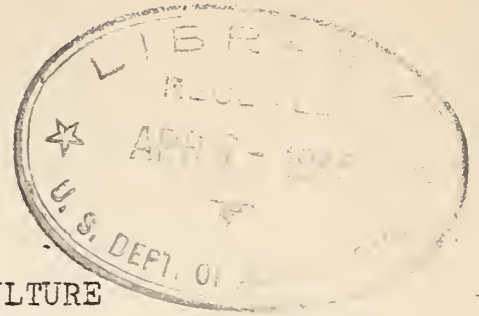


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UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
Region 8
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Regional Conservator

PRELIMINARY NOTES ON IMPORTANT VEGETATIVE
SPECIES OF REGION 8

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PRELIMINARY NOTES ON IMPORTANT
VEGETATIVE SPECIES OF REGION 8

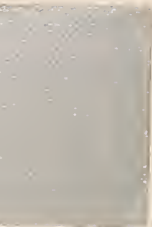
PLANT-SOIL CORRELATION CONTRIBUTION

Evan L. Flory, Ecologist and D. F. Trussell, Assoc. Soil Scientist

The range, once the history of its vegetation is understood, can be held, by judicious management, in the most desirable stage of its development for maximum feed production and effective erosion control. Why the shrubby and weedy species invade an overgrazed range or why these species in turn give way to grasses under proper management, is clearly revealed by examination of the root systems of the various species under different degrees of usage.

The rhizomes and finely divided roots of properly utilized native grasses so thoroughly occupy the upper soil mass that unpalatable shrubby and weedy species cannot invade or compete with them. Heavy overgrazing of palatable species, particularly during the growing season, will shorten and diminish their root systems and decrease the stand, creating a favorable condition for the encroachment of invaders. A continuation of this process will mean the eventual displacement of grass by shrubs and weeds that are less palatable and less erosion resistant.

Many depleted and overgrazed ranges may be restored to their former condition by judicious management, allowing the remaining grasses a chance to regain their vigor and increase their density. The finely branched grass roots occupy the surface soil so thoroughly and absorb moisture so effectively that very little penetrates deeply. The deeply rooted shrubs and weedy species are quite unfitted to compete with the grasses in the surface soil and are consequently killed out.



BLACK GRAMA (BOUTELOUA ERIOPODA)

Black grama (Bouteloua eriopoda) is indigenous to the semi-desert grasslands of the Southwest. It occupies that part of these grasslands bordering the desert scrub formation. The zone occupied by this species has a higher precipitation, slightly lower temperatures.

This species occupies soils which show a relatively mature development. Weathering during the development of these soils has resulted in the greater proportion of the clays and colloidal material being leached to the depth of the average maximum penetration of moisture. This action has given rise to a heavy-textured soil horizon at this point. This layer of soil, ("B" horizon), because of its heavy texture, is able to store large quantities of moisture. The overlying soil layer, because of the removal of the finer particles, is relatively coarse-textured, open, friable, allows water to penetrate readily, and protects the subsoil from excessive loss of moisture. The heavy-textured "B" horizon under the climatic conditions where black grama occurs begins at depths of 5 to 9 inches below the surface, depending upon the percentage and mobility of the clay resulting from disintegration of the parent material and also upon the precipitation. A large percentage of the rainfall comes in light showers which penetrate only a few inches. The high temperatures and high rate of evaporation in this habitat will dissipate the moisture in a very few hours after the showers. Black grama has developed a root system (Figure 1) that can absorb much of this moisture before it is lost. A species, in order to thrive in such a habitat, must have numerous very finely branched roots close to the

surface so that this moisture can quickly be taken up by the plant. Black grama is especially well equipped in this respect. In addition to the shallow roots, black grama also has deeper penetrating roots which draw upon stored moisture to maintain its growth through the frequent sustained drought periods. Occasionally rains occur which penetrate to and moisten the heavier textured "B" horizon.

Large areas once dominated by black grama have been largely denuded by the devitalizing effects of overgrazing. Black grama plants when properly utilized maintain their full vigor as shown by the plant to the left in Figure 1. Under such conditions the leaves are allowed to develop and remain exposed to sunlight sufficiently long for the manufacture of food to extend and maintain a normal root system and develop viable seed. Black grama plants may be maintained in this condition by grazing in the dormant season, or by judicious grazing during the growing season with provision made for an occasional rest from grazing during a growing season. Ranges where the grass still retains this degree of vigor are very rare and difficult to find. A range maintained in this condition will guarantee the stockman sustained high yields as long as the vigor of the grass is maintained. The soil mass is so thoroughly occupied by finely divided grass roots that less soil will be removed by erosion than accumulates or forms. Weeds and other less desirable forage or erosion control species are not able to obtain a foothold.

The center plant represents the condition of black grama plants on the average range in the Southwest. The number and extent of roots has been materially impaired by the consistent removal of

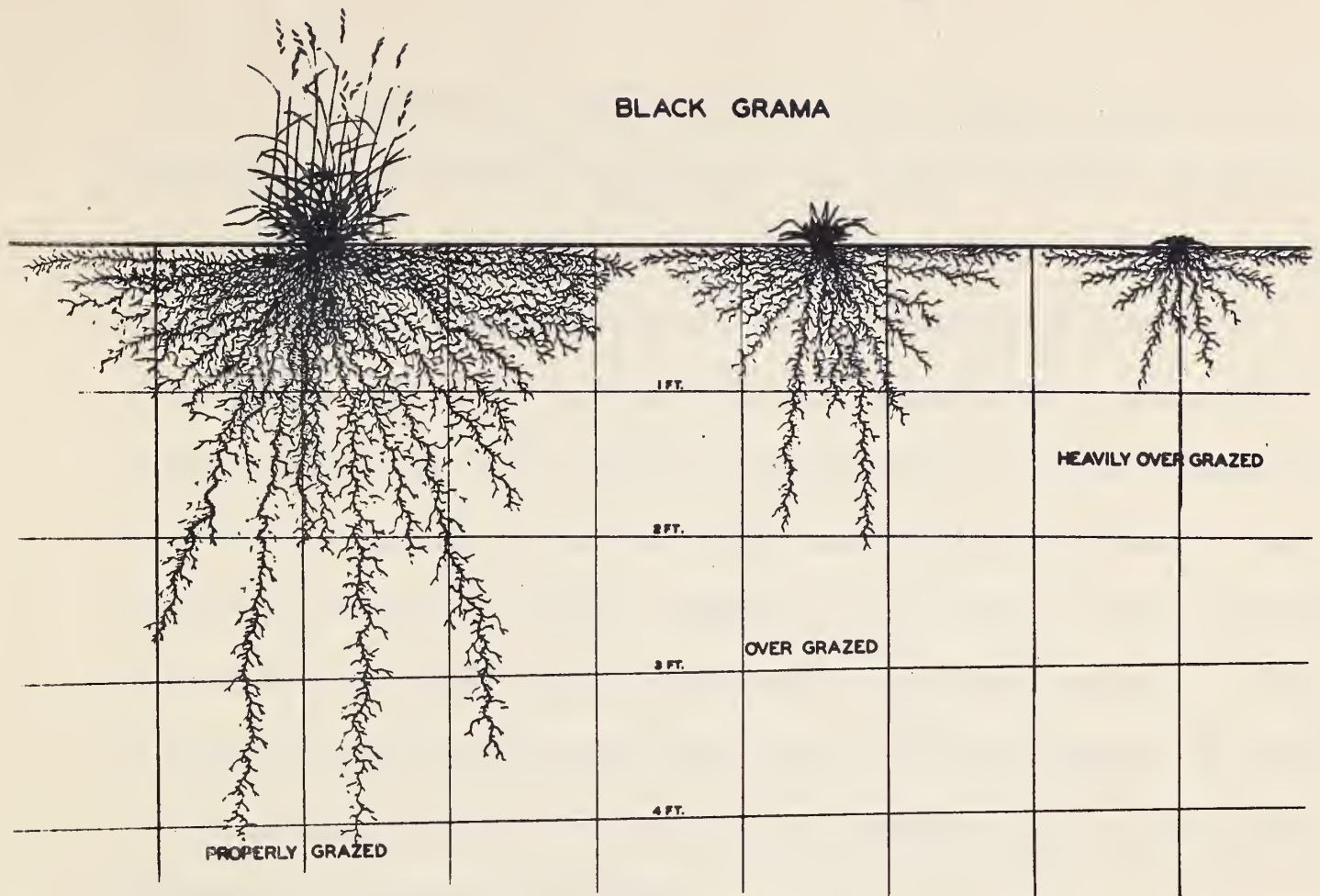


Fig. 1 - Response of black grama to different degrees of utilization.

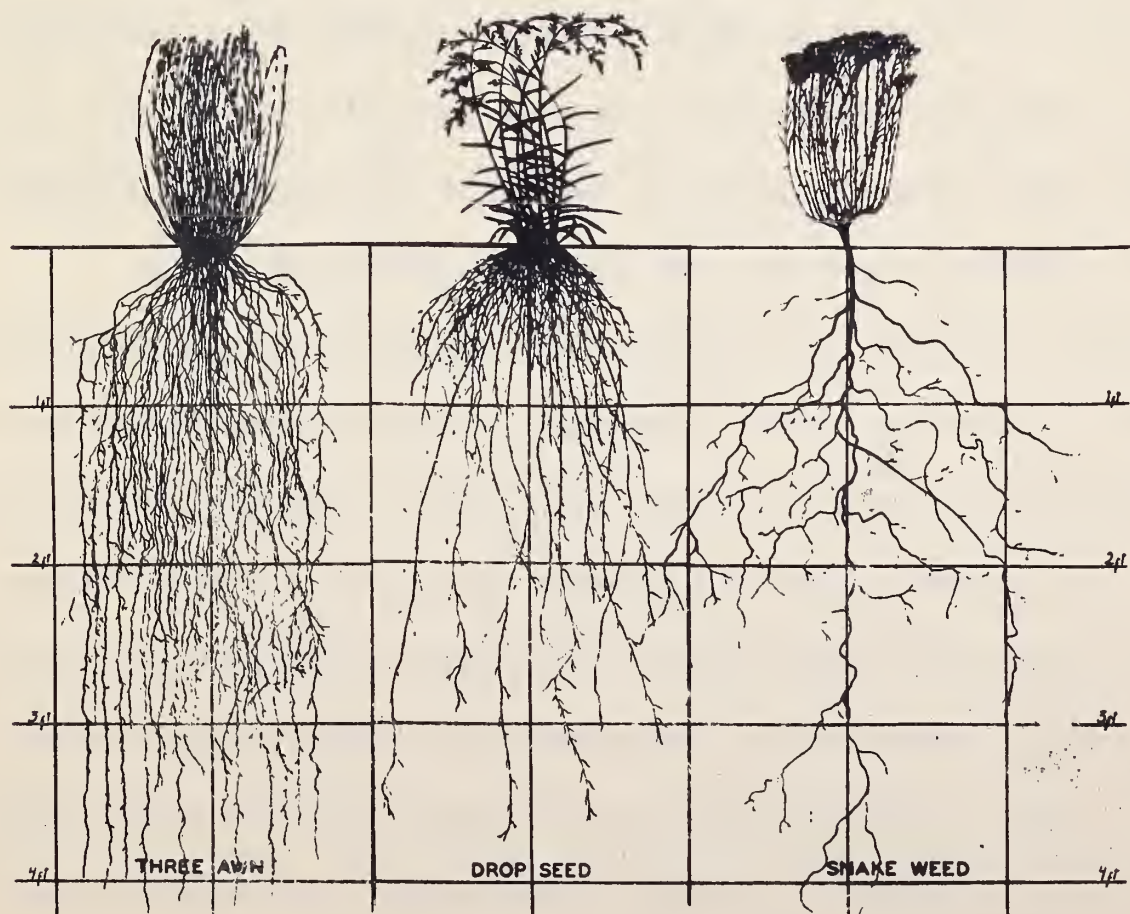


Fig. 2 - Common invaders on overgrazed semi-arid grasslands.

leaves. An insufficient photosynthetic area remains exposed to the sunlight for maintaining the vigor of the plant and the root system is restricted to conform to the lessened food supply. Less thorough occupation of the surface soil and the destruction of some of the grass plants render the surface soil more vulnerable to the action of water which will now attain some velocity due to less obstruction by decreased amounts of leaves, stems and vegetative debris. Sheet erosion is evident in varying degrees on all ranges in this condition. Less desirable forage and erosion control invaders now have a chance to compete with the weakened grama grass and they continue to assume a more dominant role as the stock do not weaken them by grazing but continue to overgraze the grama.

The root systems of three of the most common invaders of overgrazed black grama ranges are shown in Figure 2. It can be readily seen why the deeper, coarser, less finely branched roots of the invaders are much less effective in erosion control than black grama.

It is fortunate, however, that the root systems of the invaders on overgrazed black grama ranges are of such a character or they would retain complete possession of the habitat once they established dominance. When black grama is given an opportunity to regain its vigor and again approach its former density in overgrazed areas, the extensive occupation of the surface few inches of soil by finely branched grama roots shuts off the moisture of all except heavy rains from the deeper roots of the invaders. When a severe drought occurs the invaders are not able to compete with the more efficient absorbing system of black grama and the invaders are killed. Under the arid conditions where black grama is found, the above

restoration of a good black grama range free from the less desirable species must necessarily involve a period of several years. The period of time will depend largely upon the soil type, degree of depletion and climatic conditions.

Black grama in the condition shown by the middle plant is still able to maintain a fair stand where a relatively heavy textured subsoil lies within reach of most of the deeper penetrating roots, but the grass stand will be materially diminished if the upper limits of the heavier textured subsoil is deeper than 8 or 10 inches. Where the soil is relatively coarse textured throughout or the heavier textured subsoil lies deeper than the above limits, there is not sufficient water storage capacity within the absorbing zone of the restricted root system to maintain the grama through protracted drought periods. Many such areas formerly covered by a heavy grama stand are now barren and outside of local heresay, the only evidence we have of former conditions is the numerous root relics still readily perceptible in the subsoil.

In many areas these root relics not only indicate the former presence of black grama, but also its abundance and the depth to which roots extended. In areas where black grama still persists in this overgrazed and weakened condition, root relics not only indicate the former extent and penetration of the roots but also the density of stand. The plant to the right in Figure 1 represents the condition black grama may be reduced to when very heavily overgrazed through successive growing seasons. Black grama will remain alive in such a weakened condition only during a period of adequate rainfall or in those locations where a fine textured subsoil exists within a depth of 4 to 6 inches from the surface. When a drought occurs there is not sufficient storage of moisture within reach of the weakened and

shortened root systems to keep the grass alive if a coarse soil extends below the above limits. This phenomenon may be observed in many locations, but the most outstanding occurrence of this sort was in the vicinity of Bonita, Arizona. In the severe drought of 1934, several hundred acres of black and blue grama grass died out completely.

Grazing history of the area reveals that the grass has been heavily utilized throughout the growing season for many years. The constant removal of green foliage before sufficient food could be manufactured to sustain the vigor of the plants has resulted in a gradual weakening of the plants and a restriction of the root system to conform to the diminished food supply until the general feeding and absorbing level is about 6 inches deep as shown by the plants to the right in Figures 1 and 3. Where the heavy textured subsoil was only 2 to 4 inches below the surface, sufficient moisture was stored within reach of the restricted grass roots to maintain the plants through the drought period. Where the heavy textured subsoil was more than 6 inches below the surface the grass was all killed.

Depletion of this range has taken place in a relatively short time and species which commonly invade with overgrazing have not had time to establish themselves since the vigor and density of the grasses have been diminished. The area where the grass has died is without a perennial cover with the exception of scattered individuals of two species of three awn (*Aristida*). Substantial reductions in grass densities during pronounced dry periods throughout the Southwest have doubtless been due to the above cause. In most cases, however, weedy and shrubby invaders have gradually constituted a higher proportion of the total vegetative density as the grasses were weakened by selective grazing until the grasses largely disappeared in a drought after which the invader dominated the habitat.

BLUE GRAMA

Blue grama (Bouteloua gracillis) occupies that part of the semi-desert grasslands which has a higher precipitation, slightly lower temperature and a lower rate of evaporation than the part occupied by black grama. In the broad contact zone where the two species occur together, blue grama will be found on the more mature soils, north slopes, depressions and those places which have the more favorable soil moisture conditions.

Blue grama in vigorous condition (plant to left in Figure 3) has a general feeding level of about 18 inches. The major portion of its root system, however, is confined to the upper 6 or 8 inches of soil. It is indigenous, therefore, to those locations where the major portion of soil moisture lies within these limits. Blue grama is very drought resistant and has the ability to remain dormant in what would normally be a growing season if sufficient moisture is not available for the resumption of growth. During prolonged drought periods the deeper penetrating roots absorb enough moisture to sustain life.

Blue grama makes its growth in a period of 60 to 70 days after the advent of the summer rains, which is usually about the middle of July. The forage matures well on the ground and is excellent feed throughout the dormant period. Seed produced is usually of questionable viability except in infrequent years when moisture conditions are especially favorable and then only when plants are in a vigorous condition.

On those areas where blue grama is best suited to soil and other factors of the habitat and when grazed in a manner to insure the vigor of its plants blue grama will produce heavy yields of forage,

THE HISTORY OF THE UNITED STATES

The history of the United States is a story of growth and change. From the first settlers to the present day, the nation has evolved through various stages of development. The early years were marked by exploration and the establishment of colonies. The American Revolution led to the birth of a new nation, and the subsequent years saw the expansion of territory and the growth of industry. The Civil War was a pivotal moment in the nation's history, leading to the abolition of slavery and the strengthening of the federal government. The late 19th and early 20th centuries were characterized by rapid industrialization and the rise of urban centers. The Great Depression of the 1930s was a period of economic hardship, followed by the United States' entry into World War II. The post-war era saw the nation's emergence as a global superpower, with significant technological advancements and a focus on social progress. The 1960s and 1970s were marked by the Vietnam War and the civil rights movement. The late 20th and early 21st centuries have seen the nation grapple with issues of globalization, terrorism, and economic challenges. The history of the United States is a testament to the resilience and adaptability of the American people.

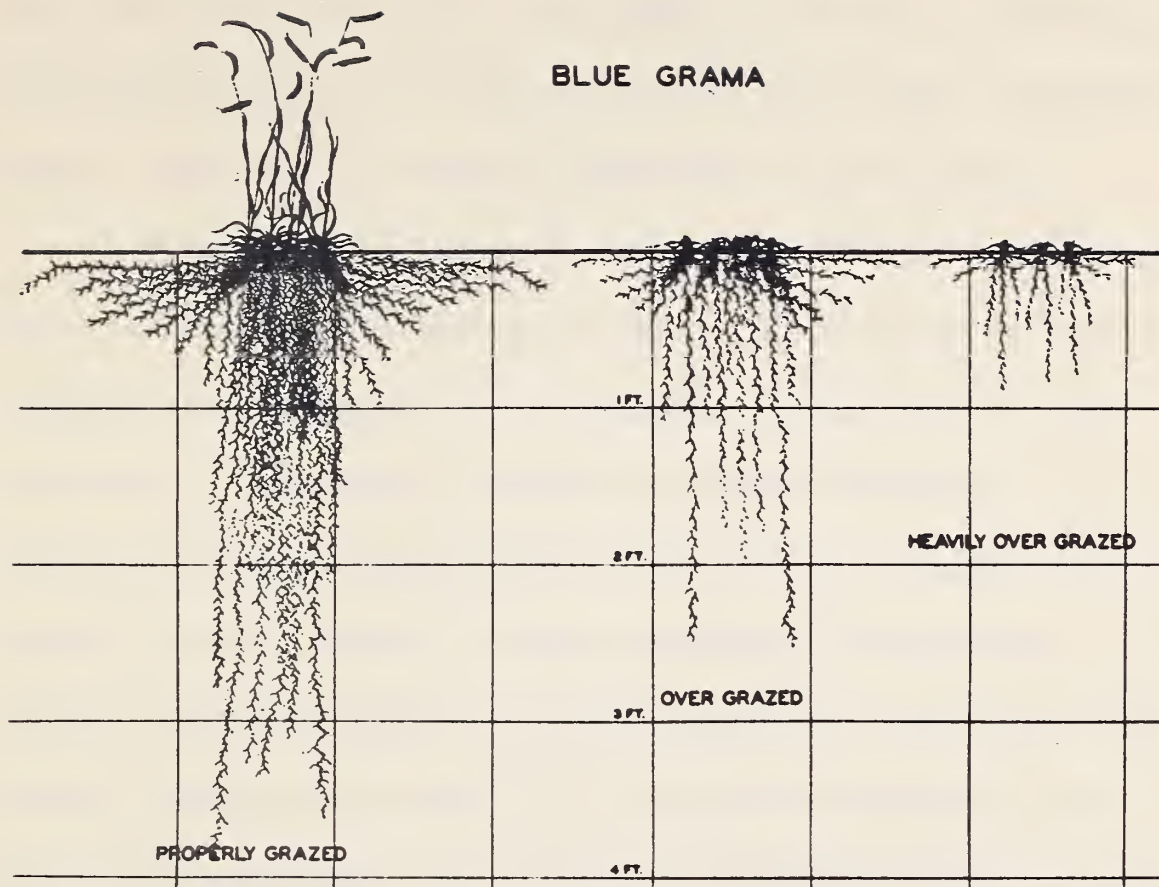


Fig. 3 - Response of blue grama to different degrees of grazing.

protect the surface from erosion by a dense vegetative cover and so completely utilize the factors of the habitat that other species will not be able to invade or compete with it.

Blue grama, because of its high palatability and occurrence in readily accessible locations, has been generally very heavily grazed. The condition of blue grama plants as found under general grazing conditions of this region is shown by the center plant of Figure 3. In this condition and in the still further weakened condition as shown to the right, deeper rooted invaders and weeds easily obtain a foothold.

The lower ranges of blue grama with lighter rainfall and those characterized by the major portion of the annual precipitation occurring within the growing season have been heavily invaded by the less desirable erosion control (Figure 2) and non-palatable, snakeweed, three awn, rabbit brush and annual weeds. The overgrazed blue grama on higher elevations where the annual precipitation is distributed

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1. The first part of the report deals with the general situation of the country and the results of the survey. It is divided into two main sections: the first section deals with the general situation of the country and the results of the survey, and the second section deals with the specific results of the survey.

2. The second part of the report deals with the specific results of the survey. It is divided into three main sections: the first section deals with the results of the survey in the field of agriculture, the second section deals with the results of the survey in the field of industry, and the third section deals with the results of the survey in the field of commerce.

3. The third part of the report deals with the conclusions of the survey. It is divided into two main sections: the first section deals with the conclusions of the survey in the field of agriculture, and the second section deals with the conclusions of the survey in the field of industry and commerce.

4. The fourth part of the report deals with the recommendations of the survey. It is divided into two main sections: the first section deals with the recommendations of the survey in the field of agriculture, and the second section deals with the recommendations of the survey in the field of industry and commerce.

over the dormant as well as the growing seasons has been heavily invaded by sagebrush. In many of the most seriously overgrazed grama ranges, sagebrush has almost completely replaced grama.

Blue grama in the very weakened condition as portrayed by the plant to the right in Figure 3, may still be alive on some areas where rainfall has continued to be adequate. Grama kept in such a depleted condition by continuous overgrazing cannot withstand a serious drought. The grass cover has been known to die out in a single dry season when weakened to this extent by heavy continuous overgrazing. On some of the more favorable grass soils blue grama has been able to live through extreme droughts even with its root systems reduced to this extent. This will happen when the surface is permeable so as to absorb a maximum amount of water and a heavy textured subsoil capable of holding large amounts of water comes to within a few inches of the surface.

An examination of the blue grama root systems as they occur under the different degrees of utilization makes it apparent that the properly utilized plant is much more effective in keeping the soil in place as it is knit very closely together by the numerous finely divided roots that come to within less than an inch of the surface.

Numerous experiments have shown that the properly utilized plant produces as much as seven times more foliage than very heavily utilized ones. The reason for this is readily apparent when the restricted leaf area of heavily grazed plants for the manufacture of food, and the fractional soil mass which their diminished root systems can draw upon for moisture and nutrients as compared to vigorous plants is considered.

GALLETA (HILARIA JAMESII)

Galleta (Hilaria jamesii) is the dominant species on the plains of northwestern New Mexico where it often forms practically pure stands many miles in extent. It is abundant over extensive areas in the upper plains and in the lower limits of the ponderosa pine belt at elevations of 5,000 to 7,000 feet in Arizona and New Mexico. It occurs chiefly in scattered stands in Utah and Colorado on mesas, plains and deserts, usually in association with blue grama in sagebrush. It attains its major development on the heavier textured soils which are calcareous in the surface or slightly saline. The species is associated with shale outcrops and shale derived soils which are slightly saline. Where the alkali content increases or the leached surface is removed by erosion, the species gives way to alkali sacaton and saltbush.

Where the vigor of the plants has not been impaired by heavy overgrazing, the tough, woody rootstalks are sometimes as long as 6 feet. The grass is so heavily overgrazed in most instances that the vigor of the plants is lessened to such an extent that the rootstalks do not develop beyond a few inches in length and the grass is restricted to a bunchlike form. The strong, scaly rootstalks and stems which are very numerous in the surface few inches of soil are more effective in the prevention of erosion than the roots which branch off the rootstalks and generally extend downward from a slightly oblique to a vertical direction.

The tough rootstalks constitute the best protection of the species against trampling and overgrazing, but the root systems are shortened and restricted as in the grammas by continuous removal of the foliage. The average condition of the range is represented by the center plant of Figure 4. Former condition of the grass plants is

